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Carbon neutral offsetting proposals for desalination plants

Iain MacGill (Joint Director, Engineering)

A-Z Guide to Going Carbon Neutral
Sydney, July 2007

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What do we mean by carbon offsets, neutrality?

- **"Carbon offsetting** - act of reducing ("offsetting") GHG emissions.
  - Idea of paying for emission-reductions elsewhere instead of reducing by own actions also known from closely related concept of emissions trading.
  - However, emissions trading, regulated by strict formal + legal framework, carbon offsets generally voluntary acts by individuals or companies commonly arranged by commercial or not-for-profit carbon-offset providers.
    - *Comment: Current Emissions Trading Schemes all have formal offset project options*
  - Wide range of offset methods
    - tree planting initial mainstay, renewable energy + energy conservation offsets now increasingly popular, purchase + withdrawal of emissions trading credits also seen"
- **"Carbon Neutral** – practice of balancing CO2 emissions from fossil fuels, with renewable energy so net emissions = 0… may extend to other GHGs
  - Oxford University Press Word Of The Year for 2006
  - Term also used in connection with practice of carbon offsetting
  - Achieve carbon neutral through combination of
    - Limiting energy usage + emissions from transportation
    - Getting electricity from a renewable energy source either directly or via greenpower.
    - Offset remaining emissions that can not for the moment be avoided or generated from renewables in responsible carbon project." *(Wikipedia.org)*

Framework for carbon offsets + neutrality

- Responsibility – legal or ethical – for greenhouse emissions associated with own actions
- Unwillingness or inability to reduce / eliminate these emissions
- Willingness + ability to pay another party to undertake emission reductions on your behalf

Key viewpoints

- Physical / scientific basis of climate change + impacts
- Physical / engineered context of emissions + abatement options
- Economics + associated regulatory / commercial arrangements
- Social considerations

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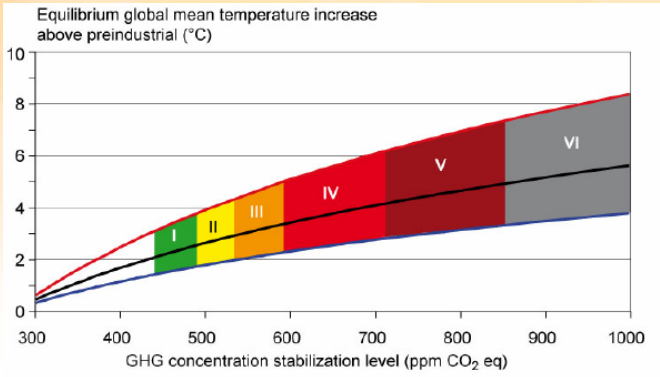
Physical basis of our climate change challenge

- Avoiding dangerous warming likely to require early (2020 peak), major (-50% by 2050) + global emissions reductions
- *Key question: How can offsets support this?*



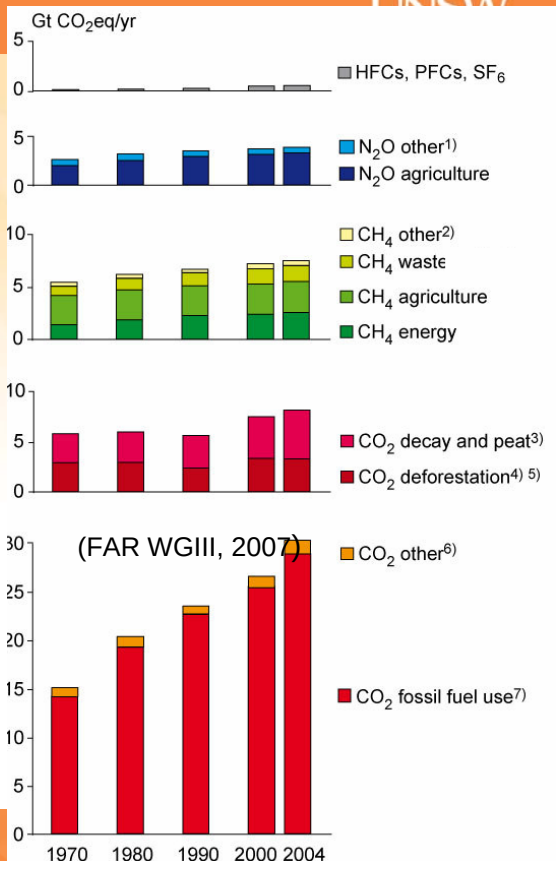
(FAR WGIII, 2007)

Table SPM.5: Characteristics of post-TAR stabilization scenarios [Table TS 2, 3.10][a)]

Category	Radiative Forcing (W/m²)[2)]	CO_2 Concentration[c)] (ppm)	CO_2-eq Concentration[c)] (ppm)	Global mean temperature increase above pre-industrial at equilibrium, using "best estimate" climate sensitivity[b), c)] (°C)	Peaking year for CO_2 emissions[d)] (year)	Change in global CO_2 emissions in 2050 (% of 2000 emissions)[d)] (%)	No. of assessed scenarios
I	2.5 – 3.0	350 – 400	445 – 490	2.0 – 2.4	2000 - 2015	-85 to -50	6
II	3.0 – 3.5	400 – 440	490 – 535	2.4 – 2.8	2000 - 2020	-60 to -30	18
III	3.5 – 4.0	440 – 485	535 – 590	2.8 – 3.2	2010 - 2030	-30 to +5	21

Current emissions sources

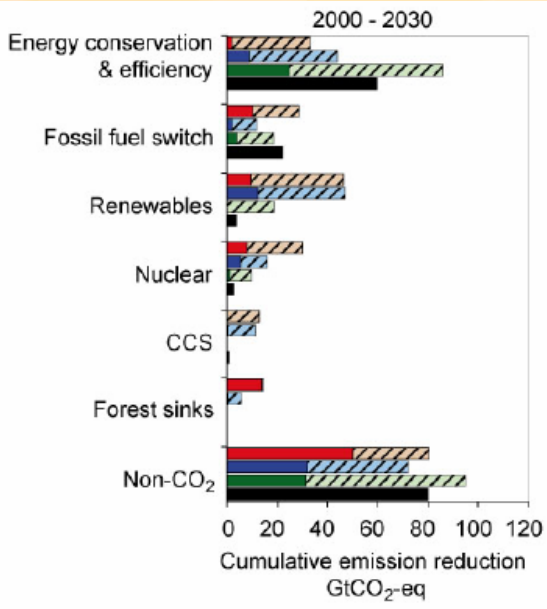
- Range of greenhouse gases from nearly all societal activities
  - Considerable difficulties measuring some emissions
- Fossil-fuels the major + fastest growing source of emissions
  - Securest form of sequestration is to leave CO2 as fossil fuels
  - A range of efficiency + lower-emission supply options
- *Key question for offsets:*
  - *How can they help transform present energy systems based on high consumption + fossil-fuels*



(FAR WGIII, 2007)

Engineering + economic perspectives

- Largest options where largest emissions – industrialised nations
  - Technical + economic drivers
- Efficiency always important
  - Productive: improve existing options
  - Allocative: between options
  - Dynamic: driving innovation + large scale change
    Key *efficiency for transformation + infrastructure has vital role*
- *Key question for offsets:*
  - *Supports lowest cost emission reduction options (productive + allocative) but what of dynamic efficiency?*



(FAR WGIII, 2007)

Economic + commercial perspectives

- Timing of abatement, risk + fungibility all critical
- Competition includes gaming rules as well as playing them
  - Risk of 'market for lemons' if social + regulatory context not right
- *Questions for offsets?*
  - *Do offsetting activities represent fungible, time + risk equivalent emission reductions compared with emission activities being offset?*

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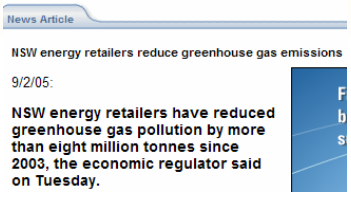


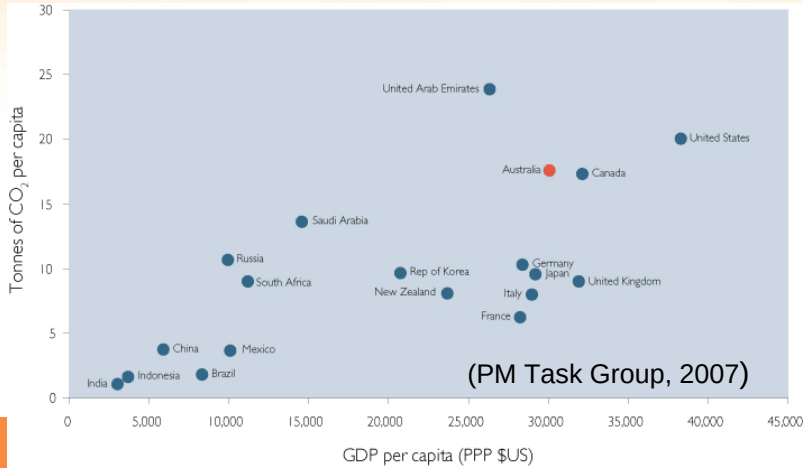
Physical, measurable emissions from fossil-fuel consumption

Estimated net CO2 fluxes from select ecosystems over time

Hypothetical estimates of emission reductions from counter-factual BAU baselines

Social perspectives

- Onus on those most contributing to problem + with resources to respond
- Any effective response will require early + major emission reductions from high emitters like Australia
- Delay in action on energy / energy intensive infrastructure + social expectations 'locks in' future emissions
- *Key question:*
  - *How do offsets impact on individual + societal action wrt both those buying offsets + those undertaking them*



(PM Task Group, 2007)

Key issues for infrastructure industries

- Definition: *set of interconnected structural elements that provide framework supporting an entire structure*
- Key infrastructure industries incl. transport, electricity, **water**
- Characteristics
  - Structural elements of economy that **enable** production + consumption of particular products or services
  - Provides organizing structure + support for system it serves
  - Often capital intensive with long asset lives
  - Often **essential** + have **natural monopoly** elements
- Decisions regarding essential natural monopoly infrastructure
  - key to transforming energy demand + supply to meet climate challenges
  - Need to be made at societal level

Desalination in Australia

- An emerging rainfall-independent water supply option for coastal cities + regions in Australia
  - Interest driven by reduced inflows into existing rain-fed systems

City	Major desalination plants + plans
Sydney	Committed 250ML/day plant
Perth	Operating 130 ML/day plant Additional plant now planned
Melbourne	Committed 450ML/day plant
Gold Coast	Committed 125ML/day plant

A possible connection to climate change?

- **Perhaps…**
  - "As a result of reduced precipitation and increased evaporation, water security problems are projected to intensify by 2030 in southern and eastern Australia
  - The region has substantial adaptive capacity due to well-developed economies and scientific and technical capabilities, but there are considerable constraints to implementation and major challenges from .. extreme events. (IPCC FAR WGII, 2007)
- **However considerable uncertainty** (CSIRO State Scenarios, 2006)

Feature		Low Global Warming Scenario		High Global Warming Scenario	
		Estimate of Change	Uncertainty	Estimate of Change	Uncertainty
Annual average temperature		+0.6°C	±0.2°C	+1.3°C	±0.6°C
Average sea level		+3cm		+17cm	
Annual average rainfall		0%	±6.5%	0%	±15%
Seasonal average rainfall	Summer	+1.5%	±8%	+3.5%	±18.5%
	Autumn	+1.5%	±8%	+3.5%	±18.5%
	Winter	-3%	±6.5%	-7.5%	±15%
	Spring	-3%	±6.5%	-7.5%	±15%
Annual average potential evaporation		+2.4%	±1.9%	+5.6%	±4.4%
Annual average number of hot days (›35°C)		+1 day		+25 days	
Annual average number of cold nights (‹0°C)		-5 day		-30 days	
Annual average number of very high and extreme forest fire danger days[b]		+1 day		+10 days	
Extreme daily rainfall intensity (1 in 20 year event)[c]		0%		+6% (east) -5% (west)	
Carbon dioxide concentration		+73ppm		+102ppm	

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Desalination is energy intensive

- Uses significantly more energy than most existing systems
- Largely electricity + Australia has one of world's most emissions intensive electricity industries
- Almost invariably grid-connected
- Plants represent significant additional loads + hence emissions (although depends on operating duty)

(Knights, MacGill & Passey, 2007)

Water Supply Option	Energy Use (kWh/kL)
Warragamba storage and pipe network	0.25
Residential greenfield wastewater reuse	1.2
Large scale indirect potable wastewater	2.8-3.8
Desalination	**5.4**
Residential Indoor Retrofit (reduces hot water use)	-33

Energy User Type	Estimated Annual Energy Use
Proposed Tugun Desalination Plant	**203 GWh/a (100 % capacity)**
Coal mine	100 – 200 GWh/a#
Major Road Tunnel Infrastructure	35 – 45 GWh/a
Major hotel / resort	10 – 15 GWh/a#
University campus	5 – 10 GWh/a#
Large shopping centre	5 – 10 GWh/a# (GCD Alliance, 2006)
Large high rise unit complex	5 – 10 GWh/a#
Theme park	1 – 5 GWh/a#

Ultra-Systems Technology Pty Limited (2005)

Offsets for desalination plant emissions

- Social + hence political pressure to offset emissions
  - Chosen response to drought potentially linked with climate change is major energy-intensive infrastructure with high associated emissions

  => All constructed / planned desal plants have associated offset arrangements in place / proposed / under evaluation
  Note that not reducing emissions, just avoiding increasing them
  - Actual emissions can difficult to estimate
    - Uncertain duty cycle depending on rainfall
    - Connected to major grids with varied generation sources + dispatch
- A range of possible offset options – market-based, informal
  - **Renewable Energy:** MRET, VRET, NSW RET, Accredited Green Power, Non-accredited Greenpower, project specific
  - 'Baseline + Credit' Emissions Reduction Scheme: CDM, NSW GGAS
  - Low-emission generation: QLD 13% Gas Scheme, project specific
  - Other possible offsets: eg. Greenhouse Friendly, commercial offset firm

Offsetting desal through carbon trading schemes

- eg. NSW GGAS, Kyoto CDM
  - Trade in notional emissions reductions (tCO2 avoided)
    - Project additionality counter-factual but vital to credibility
    - *GGAS doesn't formally test additionality*
  - Include low-emission generation, industrial projects, energy efficiency + sequestration *(not in CDM yet)*

- Potential offsets role in action on climate change
  - *Support early reductions from fossil fuels + drive dynamic efficiencies?*

    Fungible, time + risk equivalent reductions c.f. emission activities?
    - Some projects but many not energy-related + less secure (eg. tree planting), represent relatively minor changes from BAU (eg. more efficient coal plant),
    - Some projects clearly not additional, lack credibility – risk market for lemons
  - *How do offsets impact on individual + societal action wrt buyers + sellers*
    - Credibility + integrity issues, windfall profits risk loss of public support

Offsetting desal through renewable energy

- User ' buying renewable energy' an accounting *abstraction*
  - Electricity from particular gen. (eg wind) can't be *directed* to particular load (eg desal) in shared network
  - Possible definition of Greenhouse neutral: *additional* renewable generation onto network equal to electricity consumption of plant
  - *Additional renewable energy:*
    - Has to be **additional** wrt BAU renewables (eg. Snowy), regulated targets (eg. MRET) , voluntary support by other users (Accredited Green Power)
- Potential offsets role in action on climate change
  - *Support early reductions from fossil fuels+ drive dynamic efficiencies?*

    Fungible, time + risk equivalent reductions c.f. emission activities?
    - Yes - supports renewable energy industry development. Fungibility impacted by generation mix + dispatch
  - *How do offsets impact on individual + societal action*
    - Credibility always key but strong public support for these 'new entrants'

Perth Desalination Case Study

- 130 ML/day plant now operational, 15%+ of Perth demand (source Water Corporation)
- Plant connected to SWIS- predominant gas + coal gen. mix
- Expected 185 GWh/year, Water Corp emissions +50%
- "Powered" by the Emu Downs Wind Farm
  - "brilliant example of sustainability being put in to practice...the pairing of the desalination plant + wind farm is a win for the environment" Gallop
  - Water Corporation "will pay for electricity at Emu Downs and fed in to Western Power's grid…and will draw out the equivalent amount of electricity from the grid on an annual basis"
- **However,**
  - **RECs purchased by Western Power for MRET obligations**

  => questionable additionality for renewable energy 'powering' plant
- A more credible + robust approach
  - 100% Accredited Green Power or specific project separate to any mandatory scheme

GreenPower Accredited Renewable Energy

Wider Sustainability Issues

- For equitable global CC action, Australia 90%+ reduction target?
- Offsetting desal plants in Australian context necessary but doesn't reduce emissions, only doesn't increase them
- 'Additional' renewable energy most credible + valuable offset
- **However**
  - Almost certainly practical limits to overall amount + penetration of renewable resources in our electricity industry
  - In future carbon constrained world, energy choices ever more critical
  - Growing competition for limited supply resource might see desal. competing against IT + other high value uses in the future
  - Large capital investment might make desal "option foreclosing" on other approaches
  - Social impacts may also be significant
    - A choice between desal over water restrictions + reuse?

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Thank you… and questions?

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